BUREAU OF STANDARDS SURVEY

GOVERNMENT'S GREAT SCIENCE PLANT

AWAY from the dirt and noise of the city, on the top of one of Washington's high spots, is a group of buildings that house the laboratories and offices of the National Bureau of Standards, a part of the Department of Commerce. There a staff of nearly 800 physicists, chemists, engineers and other necessary personnel not only establish the standards of quality, performance and practice, and determine the physical and chemical constants that are used in scientific and everyday life, but arrive at the technical solution of practical problems of the steel, cement, ceramic, paper, rubber and textile, and other industries, and work out the fundamental problems of pure science for the commercial uses of the future. Nearly as many phases or lines of work are being conducted there as there are employes.

Since March 3, 1901, when the bureau was created by Congress, it has been steadily growing. Dr. S. W. Stratton has been its director from the very beginning, and he has planned its evolution into an immense research plant, so large that the brick, ivy-covered building, first of the bureau's group, but now used as a low temperature laboratory, would be swallowed up in one wing of the new industrial laboratory building. During the war nearly half of the present number of buildings were erected and in 1918 the personnel peak of 1,200 employes was reached.

The bureau's work of development, construction, custody and maintenance of reference and working standards and their intercomparison, improvement and application in science, engineering, industry and commerce, falls into several classes. The official standards of mass, length and volume rest in the bureau's vaults, and regulate all the weights and yardsticks of the country. This is accomplished by calibrating the reference standards of States, cities and manufacturers that in turn duplicate them for the ultimate consumer. All sorts of commercial products and apparatus are tested, largely at the request of the various government departments, which wish to be guided in their purchasing by tests. This not only safeguards the people's money, but keeps the bureau in touch with the needs of the industries, allows it to develop improved methods, apparatus and materials and provides information to be used in writing specifications for materials and apparatus. Specifications or standard practice, such as safety codes, that cover construction, installations and operation in factories and elsewhere are also formulated or revised as a result of studies made at the bureau.

The bureau has kept pace with electrical developments during the past two decades. Now its electrical work covers nearly every field. Its electrical investigations range from tests of big gun pressures for the navy to the determination of the resistance of the human body. During the last fiscal year the government bought 1,500,000 incandescent lamps and samples from these were tested there. A radio direction finder and a radio fog signalling system are important contributions made by the bureau to wireless advancement. Electrolysis caused by stray electric currents has been studied in an effort to prevent its great economic losses and dangers. Various systems of automatic telephony are being studied and tested. Dry cells and storage batteries are analyzed and their applications worked out. About $2,500,000 worth of radium, or 25 grams, were tested and certified by the bureau last year, and certifications for radium that was shipped to about twenty countries were made. The electrical division has also conducted public utility investigations, formulated standards for electric service, street-lighting service, heating service, and aided in the preparation of the national electrical safety code, various industral safety standards, and the national gas safety code.

All matters pertaining to standards of length, mass or weight as it is commonly termed, time, density and similar questions are handled by the division of weights and measures. Yardsticks and meter bars, steel and cloth tapes, sieves, level rods and polariscope tubes, as well as many thousand weights are tested. All sorts of timepieces from chronometers to stop watches are rated. Burettes, pipettes and flasks used in chemical and medical work are tested for capacity. The thermal expansions of steel, celluloid, brasses, molybdenum, glass and even the alloys used in tooth-filling are measured. The bureau tests master scales in railroad centers and checks mine and grain scales by using special scale-testing automobiles. Gauges used to control the manufacture of interchangeable machine parts on a large scale in the industries, are calibrated.

Heat standards and heat constants are determined by the division of heat and thermometry, which also tests heat measuring apparatus. Clinical thermometers, thermocouples, pyrometers, and other temperature measuring devices from the coldest possible temperature to the highest obtainable temperatures are calibrated. Fundamental physical constants of materials used in refrigeration have been determined and the low-temperature laboratory has made and studied properties of liquid air, carbon dioxide, acetylene, hydrogen and oxygen. Building columns have been fire-tested at high temperatures. To find out how an airplane engine behaves at high altitudes a laboratory in which all the conditions of upper air flying can be duplicated has been built. Fundamental problems of design and operation of internal-combustion engines and accessories, such as lubrication of engines, cooling, carburetion, ignition and the phenomena of combustion, are being studied. Data on fuels are being compiled.

Light and optical problems are handled by a special division. A method of photographing through haze by means of red light was developed by the spectroscopy section, which is also working on photosensitizing dyes, photographic emulsions, and other special investigations. Polarized light and its properties have been investigated and by means of it sugar and oils are tested. The colorimetry work deals with the light frequencies or wave-lengths and their intensities that produce the sensation of color. Tests of optical instruments are made. Glasses that protect the eyes from injurious radiations are studied. Searchlights were tested during the war.

In the chemistry division many tests of materials for composition and purity in connection with researches upon methods of analysis, specifications for technical materials, and preparation of pure materials for standardization work are made. Investigations of electroplating have been made and methods of analyzing fuel and illuminating gases have been developed. Chemical reagents, platinum, lubricating oils, rubber, paper, textiles, ink, glue, airplane dopes are tested and other sections analyze iron, steel, nonferrous metals, alloys, lime, plaster, cement, bituminous materials, paint, varnish and soap.

Investigations relating to mechanics and sound, the testing and development of engineering instruments, experimental development of aircraft instruments, and the analysis and correction of accoustical defects of assembly rooms are undertaken by the division of engineering physics. In a long tank of still water, water current meters are rated. Various aeronautic instruments have been developed. The resistance of projectiles at high air speeds and the aerodynamical characteristics of tiny airplane models are tested in tunnels with air speeds up to 250 feet a second.

Nearly all the materials ordinarily used in industrial work are investigated and tested by the division of structural, engineering and miscellaneous materials. Among the tests that have been made are strain-gauge measurements, of a 350-ton crane, efficiency tests of oxyacetylene torches for welding and cutting, fireproof qualities of airplane wings, effect of acid on rope, strength of metal fenceposts and physical properties

(CONTINUED ON PAGE TEN.)

AIRPLANE VIEW of the National Bureau of Standards, Connecticut avenue and Pierce Mill road, looking toward northwest. 1—West building. 2—Experimental stucco building. 3—Altitude and dynamometer laboratory buildings for automotive power plant testing. 4—Wind-tunnel building. 5—Low temperature laboratory, the first building of the bureau. 6—South or administrative building. 7—Northwest building. 8—North building. 9—Electrical building. 10—Radio building. 11—Chemistry building. 12—Industrial building. 13—Group of army barracks.

Div. I—Electrical.
E. B. ROSA, Chief.
1—Standards of Resistance. F. WENNER.
2—Inductance and Capacity. H. L. CURTIS.
3—Elec. Measuring Instruments. E. B. BROOKS.
4—Magnetic Measurements. R. L. SANFORD.
5—Photometry and Illumin. Engrg. E. C. CRITTENDEN.
6—Radio Communication. J. H. DELLINGER.
7—Electrolysis Prevention. B. McCOLLUM.
8—Safety Engineering. M. G. LLOYD.
9—Gas Engineering. W. M. BERRY.
10—Electrical Service Standards. J. F. MEYER.
11—Telephone Service Standards. F. A. WOLFF.
12—Electro-Chemistry. G. W. VINAL.
13—Radio-Activity, X-ray Meas. W. H. WADLEIGH.

Div. II—Wts. & Measures.
L. A. FISCHER, Chief.
1—Length. L. V. JUDSON.
2—Mass. A. T. PIENKOWSKY.
3—Time. A. F. BEAL.
4—Capacity and Density. E. L. PEFFER.
5—Gas Measuring Instruments. H. S. BEAN.
6—Thermal Expansivity. W. H. SOUDER.
7—Wts. & Meas. Laws Administration. F. S. HOLBROOK.
8—Inv. and Tstg. of Scales. F. S. HOLBROOK.
9—Gages. H. W. BEARCE.

Div. III—Heat & Thermometry.
C. W. WAIDNER, Chief.
1—Thermometry. E. F. MUELLER.
2—Pyrometry. P. D. FOOTE.
3—Heat Measurements. E. F. MUELLER.
4—Technical Thermodynamics.
5—Liquid Air Plan. C. W. KANOLT.
6—Fire Resistance. S. H. INGBERG.
7—Aero. Power Plants. H. C. DICKINSON.

Div. IV—Optics.
C. A. SKINNER, Chief.
1—Spectroscopy. W. F. MEGGERS.
2—Polarimetry. F. J. BATES.
3—Colorimetry. I. G. PRIEST.
4—Optical Instruments C. A. SKINNER.
5—Radiometry. W. W. COBLENTZ.
6—Dispersed Physics. P. V. WELLS.
7—
8—Interferometry. C. G. PETERS.

Div. V—Chemistry.
W. F. HILLEBRAND, Chief.
1—Physical Chemistry.
2—Electro-Chemistry. W. BLUM.
3—Metallurgical.
4—Gas Chemistry. E. R. WEAVER.
5—Reagents, Platinum. F. W. SMITHER.
6—Analytical Methods and Standards. G. E. LUNDELL.
7—Rubber, Paper, Textiles, etc. C. E. WATERS.
8—Metals, Cements, Bitum. Mtrls. S. S. VOORHEES.
9—Paint, Varnish, Soap. P. H. WALKER.

Div. VI—Mech. Appli. & Engr. Instr.
L. J. BRIGGS, Chief.
1—Engrg. Inst. & Mech. Appli. W. F. STUTZ.
2—Sound. E. A. ECKHARDT.
3—Aeronautic Instruments. F. L. HUNT.
4—Aerodynamical Physics. H. L. DRYDEN.

Div. VII—Struc., Engrg. & Misc. Mtrls.
F. H. BATES, Act. Chief.
1—Mech. Tsts. of Met. & Met. Struc. H. L. WHITTEMORE.
2—Cement, Sand & Stone. J. C. PEARSON.
3—Rubber, Leather, Etc. P. L. WORMELEY.
4—Textiles. F. R. McGOWAN.
5—Paper, F. A. CURTIS.
6—Lubricating Oils. W. H. HERSCHEL.
7—Lime, Gypsum, Etc W. E. EMLEY.

Div. VIII—Metallurgy.
G. K. BURGESS, Chief.
1—Optical Metallurgy. H. S. RAWDON.
2—Thermal Metallurgy. H. J. FRENCH.
3—Mechanical Metallurgy. R. W. WOODWARD.
4—Chemical Metallurgy. L. JORDAN.
5—Experimental Foundry. C. P. KARR.

Div. IX—Ceramics.
F. H. BATES, Act. Chief.
1—Clay Products. F. H. BATES.
2—Optical Glass. W. A. HULL.
3—Refractories. W. A. HULL.
4—Enameled Metals. R. R. DANIELSON.

Office
H. D. HUBBARD, Chief.
1—Finance. D. E. THOMAS.
2—Personnel. W. C. FEWELL.
3—Purchase. S. W. CAYWOOD.
4—Property & Transportation. G. H. VANEMAN.
5—Mails and Files. R. W. LAMBERSON.
6—Library. A. FANTI.
7—Information. H. G. BOUTELL.

Operation of Plant
C. SCHNEIDER, Chief.
1—Power Plant. L. J. McILVAINE.
2—Refrigeration. L. J. McILVAINE.
3—Storage Batteries. L. J. McILVAINE.
4—Buildings and Grounds. F. A. PETERS.
5—Extension and Maintenance. A. E. HANSON.
See Cont. 4 and 5.
6—Plant Stores. J. C. BOYLE.

Construction
S. W. STRATTON, Chief.
1—Instruments and Machine Shops. O. G. LANGE.
2—Woodworking Shops. L. R. DOWNS.
3—Glass-Blowing Shop. E. O. SPERLING.
4—Plumbing and Piping. J. P. McKEON.
5—Wiring and Electric Work. A. A. LUDWIG.
6—Glass Grinding Shop. F. C. WEAVER.
7—Photographic Shop. R. DAVIS.
8—Construction Stores.